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The richness and paucity of the spider fauna of the Belgian coast

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Abstract

A comparison is made between the spider species composition of twelve sandy natural areas in Flanders along a gradient from the coast dunes and salt marshes in the west to the large heath land areas in the east. All these natural areas have large numbers of rare and threatened species. The relative paucity in spider species in coastal reserves is caused by the lack of species bound to ombrotrophic *Sphagnum* bog vegetation and to wet oligotrophic grasslands.

Keywords: Spiders, Belgian coast, coastal dunes, salt marshes, heath lands, peat bogs, oligotrophic grasslands.

Introduction

Recently a Red list for the spider fauna of Flanders was compiled (MAELFAIT *et al.*, 1998). Flanders is the northern part of the federal state of Belgium. It has a surface of approximately 13.500 km^2, whilst the total surface of Belgium is 30.500 km^2. The spider fauna of Belgium comprises 689 species; that of Flanders 604. As can be found in the above mentioned Red list only about half of the 604 Flemish spider species belongs to the "Safe or at low risk"-category. This high degree of threat is understandable when one realises that human population density in Flanders is more than 420/km, i.e. more than three times the mean of the population density of the European community. Consequently, the remaining natural and semi-natural areas and nature reserves are scarce in Flanders; they are small and isolated from each other.

Other categories distinguished in the Red list are: Extinct, Threatened (with three different degrees: Critical, Endangered and Vulnerable), Indeterminate (species assumed to be in threat but of which there is not enough information to decide which of the threat categories is appropriate), Restricted geographically (species which are rare in the considered region due to their geographical distribution, i.e. species for which Flanders lays at the northern, southern or western limit of their distribution range) and Insufficiently known (species for whose there is insufficient information to judge into which category they should be placed and also those species mentioned doubtfully to occur in our region). The number of species belonging to each category is listed in Table 1. For each

Table 1 — Number of species per Red list category of the spider fauna of Flanders.

Red list-category (RLC)	*Number*
Extinct (EX)	8
Critical (CR)	58
Endangered (EN)	83
Vulnerable (VU)	63
Restricted Geographically (RG: N-, S- or W-limit)	65
Indeterminate (IN)	12
Insufficiently Known (IK)	24
Safe, low risk	291
TOTAL	604

Table 2 — Number of species belonging to the Red list categories Extinct, Critical, Endangered and Vulnerable per habitat type.

Habitat	*Number*
Forest, deciduous, dry (Fdd)	26
Forest, deciduous, marshy (Fdm)	6
Forest, deciduous, wet (Fdw)	7
Grassland, oligotrophic, dry (God)	78
Grassland, oligotrophic, wet (Gow)	22
Heathland, dry (Hd)	19
Heathland, wet (Hw)	16
Marshland (M)	24
Riparian habitat (R)	6
Saltmarsh (Sa)	6
Water habitat, eutrophic (We)	2
TOTAL	212

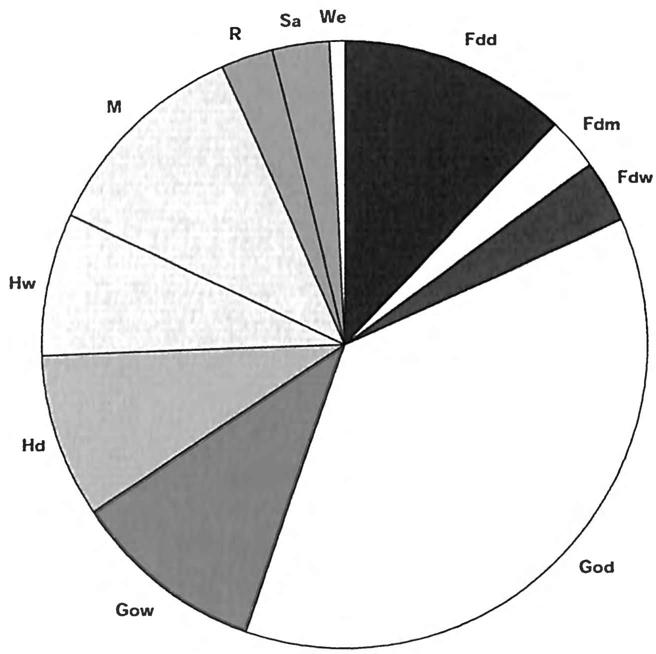


Fig. 1 — Habitats preferred by the Extinct, Critical, Endangered and Vulnerable spider species of Flanders.

species, which belong to the categories Threatened and Extinct, the habitat could be characterised as being one of the following types: dry, marshy or wet deciduous forest, dry or wet oligotrophic grassland, dry or wet heath land, marshland, riparian habitat, salt marsh or unpolluted eutrophic water habitat. In Table 2 the number of the threatened species per habitat type is given. Figure 1 visualises the relative frequency of the habitat types in which the 204 Threatened and 8 Extinct species occur or occurred. We thus can conclude that the vast majority of species in the threatened part of the spider biodiversity of Flanders occur in dry and wet open habitats, i.e. grassland, heath land, marshland, riparian habitat, salt marsh and water habitats.

Of the whole of the natural and semi-natural areas, which have been sampled quite exhaustively for their spider fauna, the highest spider biodiversity is found in the sandy regions of Flanders (MAELFAIT & BAERT, 1999). The most typical biotic elements of these regions are species bound to open habitats (non-forest species). Therefore, we compare and analyse the relative richness of the different Flemish sandy regions based on rare and threatened spiders of open habitats.

One sandy part of Flanders occurs along the coast (Fig. 2). It is a narrow zone of a few kilometres wide with two salt marshes and some thousand five hundred hectares highly fragmented dry and wet coastal dune habitats. Dry dune tops with marram grass, sedge-, and lichen- and moss-vegetation contrast with waterlogged dune slacks. The dune soil is made up of quaternary deposits of lime rich sand. A large part of Flanders is made up of the loamy sand region. Some parts of this region are sandier. They occur south of Bruges in the north of the province of

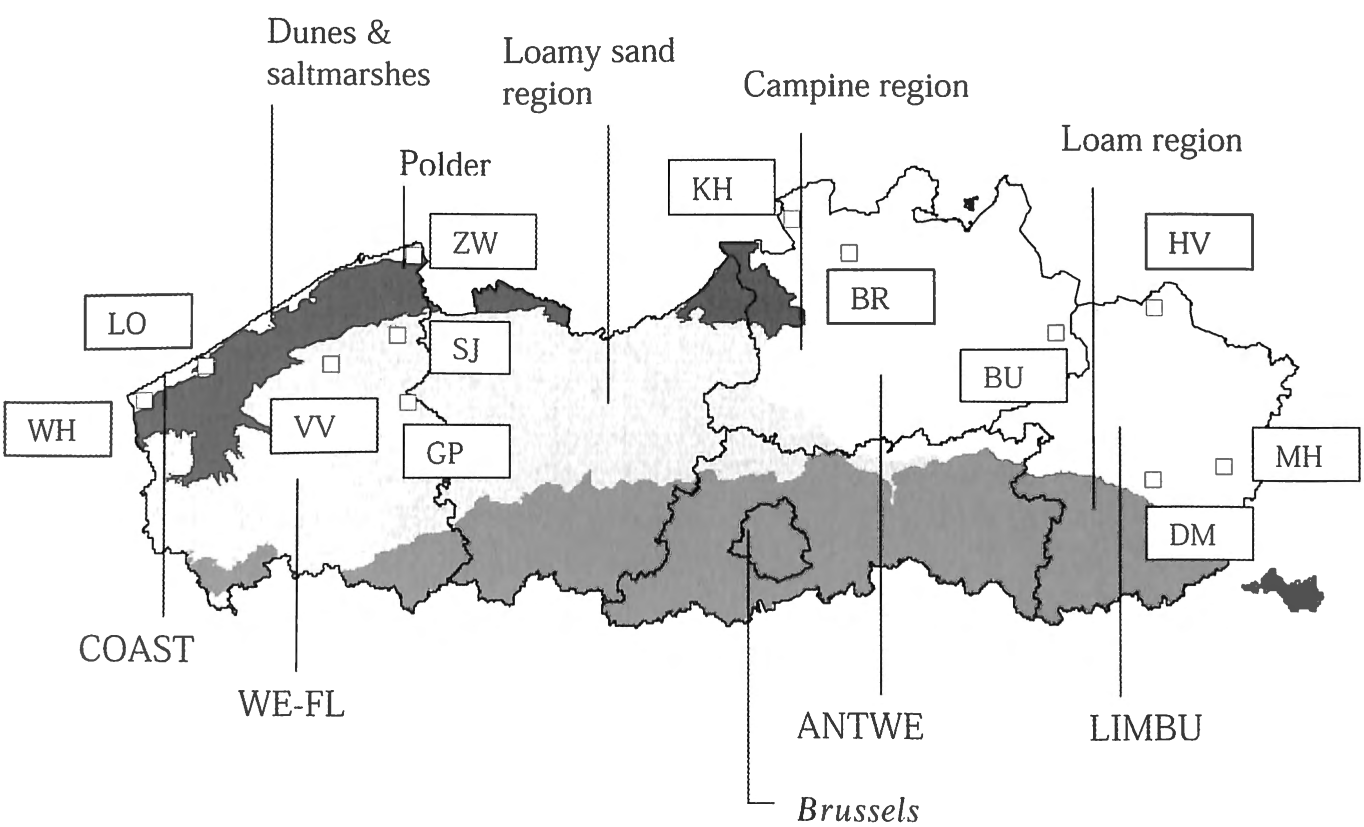


Fig. 2 — Localisation of the twelve sandy areas for which the biodiversity in spiders fauna is compared. Further explanation: see text.

Table 3 — Red list species (forest bound species excluded) present in: (1) each of the twelve considered areas, (2) each group of three areas , (3) all of the twelve areas (ALL 12) and (4) Flanders (FLAND). For each species its Red list category and its preferred habitat is indicated (further explanation: see text an Tables 1 and 2).

Species	DM	HV	MH	LIMBU	BR	BU	KH	ANTWE	GP	SJ	VV	WE-FL	LO	WH	ZW	COAST	ALL 12	FLAND	RLC	HAB
Atypus affinis		1	1	1	1	1	1	1		1	1	1					1	1	VU	God
Altella lucida							1	1									1	1	RG	N
Argenna patula													1		1	1	1	1	CR	Sa
Argenna subnigra													1	1	1	1	1	1	EN	God
Dictyna civica																		1	RG	N
Dictyna latens	1			1		1		1	1			1					1	1	EN	God
Dictyna major	1			1													1	1	RG	S
Dictyna pusilla					1			1							1	1	1	1	EN	God
Lathys puta																		1	RG	N
Mastigusa arietina							1	1					1			1	1	1	EN	God
Zodarion rubidum																		1	RG	N
Coriarachne depressa	1			1													1	1	RG	S
Heriaeus hirtus																		1	RG	N
Misumena vatia	1		1	1			1	1									1	1	VU	God
Misumenops tricuspidatus	1			1													1	1	RG	N
Ozyptila atomaria									1		1	1	1		1	1	1	1	EN	God
Ozyptila brevipes																		1	EN	Gow
Ozyptila nigrita																		1	CR	God
Ozyptila sanctuaria											1	1	1	1	1	1	1	1	EN	God
Ozyptila scabricula	1		1	1			1	1									1	1	EN	Hd
Synaema globosum																		1	RG	N
Thomisus onustus							1	1									1	1	RG	N
Tmarus piger																		1	RG	N
Xysticus acerbus																		1	CR	Hd
Xysticus bifasciatus																		1	CR	God
Xysticus erraticus		1		1	1			1		1		1	1	1	1	1	1	1	EN	God
Xysticus ferrugineus							1	1	1		1	1					1	1	RG	N
Xysticus kempelini			1	1													1	1	RG	N
Xysticus ninnii	1		1	1													1	1	EN	God
Xysticus sabulosus							1	1					1	1		1	1	1	EN	God
Aelurillus v-insignitus	1	1		1	1		1	1							1	1	1	1	VU	God
Bianor aurocinctus																		1	EN	God
Euophrys aequipes	1	1		1			1	1					1			1	1	1	VU	God
Euophrys petrensis					1		1	1			1	1					1	1	EN	God
Evarcha laetabunda		1	1	1			1	1									1	1	EN	Hd
Heliophanus auratus																		1	EN	M
Heliophanus dubius																		1	RG	S
Heliophanus tribulosus	1			1													1	1	RG	N

Species	DM	HV	MH	LIMBU	BR	BU	KH	ANTWE	GP	SJ	VV	WE-FL	LO	WH	ZW	COAST	ALL 12	FLAND	RLC	HAB
Marpissa nivoyi													1	1	1	1	1	1	EN	God
Marpissa pomatia																		1	CR	M
Marpissa radiata	1			1													1	1	VU	M
Neon valentulus		1		1		1		1									1	1	CR	Hw
Pellenes tripunctatus			1	1													1	1	EN	God
Philodromus buxi																		1	RG	N
Philodromus fallax													1	1		1	1	1	CR	God
Philodromus histrio			1	1	1			1									1	1	VU	Hd
Philodromus rufus																		1	RG	N
Phlegra fasciata	1			1			1	1		1		1	1	1	1	1	1	1	VU	God
Sitticus caricis	1			1	1	1	1	1									1	1	EN	M
Sitticus distinguendus																		1	EN	God
Sitticus floricola	1			1													1	1	VU	M
Sitticus saltator	1			1			1	1					1	1	1	1	1	1	EN	God
Synageles hilarulus		1	1	1													1	1	RG	N
Thanatus striatus		1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	VU	God
Tibellus maritimus					1		1	1					1		1	1	1	1	VU	Gow
Tibellus oblongus		1		1	1	1		1	1			1					1	1	VU	Gow
Oxyopes lineatus																		1	RG	N
Oxyopes ramosus					1		1	1									1	1	VU	Hd
Alopecosa barbipes	1	1	1	1			1	1			1	1	1	1	1	1	1	1	VU	God
Alopecosa cuneata	1		1	1						1		1	1		1	1	1	1	VU	God
Alopecosa fabrilis	1			1			1	1					1	1		1	1	1	EN	God
Alopecosa taeniata																		1	RG	S
Arctosa cinerea																		1	CR	R
Arctosa figurata		1		1			1	1									1	1	RG	N
Arctosa leopardus	1	1	1	1	1	1	1	1	1	1		1		1		1	1	1	VU	Gow
Arctosa perita	1	1		1	1		1	1					1	1	1	1	1	1	EN	God
Callilepis nocturna																		1	RG	N
Drassodes pubescens	1	1		1		1		1			1	1		1		1	1	1	EN	God
Gnaphosa leporina	1	1		1			1	1									1	1	EN	Hw
Gnaphosa lucifuga																		1	CR	God
Gnaphosa nigerrima						1		1									1	1	CR	Hw
Gnaphosa opaca																		1	RG	N
Haplodrassus dalmatensis	1			1			1	1					1	1	1	1	1	1	EN	God
Haplodrassus umbratilis																		1	CR	God
Micaria dives		1		1			1	1					1	1		1	1	1	CR	God
Micaria fulgens		1		1										1		1	1	1	EN	God
Micaria romana													1	1		1	1	1	RG	N
Micaria silesiaca	1		1	1													1	1	RG	N
Pardosa agrestis																		1	EN	R

Species	DM	HV	MH	LIMBU	BR	BU	KH	ANTWE	GP	SJ	VV	WE-FL	LO	WH	ZW	COAST	ALL 12	FLAND	RLC	HAB
Pardosa agricola																		1	CR	R
Pardosa hortensis			1	1	1			1		1		1					1	1	RG	N
Pardosa monticola	1	1	1	1			1	1					1		1	1	1	1	EN	God
Pardosa prativaga	1	1	1	1	1	1	1	1									1	1	VU	M
Pardosa proxima		1		1										1		1	1	1	RG	N
Pardosa purbeckensis													1		1	1	1	1	CR	Sa
Pardosa sphagnicola	1	1	1	1	1	1	1	1	1			1					1	1	CR	M
Phaeocedus braccatus		1		1	1		1	1									1	1	EN	Hd
Pirata piscatorius	1	1	1	1	1	1	1	1									1	1	EN	M
Pirata tenuitarsis	1	1	1	1	1	1	1	1									1	1	CR	M
Pirata uliginosus	1	1	1	1	1	1	1	1									1	1	CR	Hw
Poecilochroa conspicua																		1	RG	N
Trochosa robusta																		1	CR	God
Trochosa spinipalpis	1	1	1	1	1	1		1									1	1	VU	Gow
Xerolycosa miniata	1			1	1			1		1		1		1	1	1	1	1	EN	God
Zelotes aeneus																		1	RG	N
Zelotes electus	1	1		1							1	1	1	1	1	1	1	1	VU	God
Zelotes longipes	1	1	1	1		1	1	1					1	1	1	1	1	1	VU	God
Zelotes lutetianus	1	1		1		1		1									1	1	EN	Gow
Zelotes pedestris										1	1	1	1	1	1	1	1	1	EN	God
Zelotes petrensis	1	1	1	1	1	1	1	1							1	1	1	1	VU	God
Zelotes praeficus						1		1									1	1	CR	Hd
Cheiracanthium pennyi			1	1													1	1	RG	N
Cheiracanthium virescens		1		1	1		1	1		1		1	1	1	1	1	1	1	EN	God
Cheiracantium montanum														1		1	1	1	RG	N
Clubiona frisia													1	1	1	1	1	1	VU	God
Clubiona genevensis																		1	CR	God
Clubiona juvenis																		1	CR	M
Clubiona subsultans	1			1													1	1	RG	S
Clubiona trivialis	1			1	1		1	1						1		1	1	1	VU	God
Dolomedes fimbriatus					1	1	1	1									1	1	CR	M
Dolomedes plantarius																		1	CR	We
Agraecina lineata																		1	RG	N
Agroeca cuprea													1	1	1	1	1	1	EN	God
Agroeca dentigera			1	1	1		1	1									1	1	CR	Hw
Agroeca lusatica	1	1	1	1	1			1					1	1	1	1	1	1	VU	God
Argyroneta aquatica		1	1	1	1		1	1	1			1					1	1	VU	We
Phrurolithus minimus																		1	CR	God
Scotina celans									1			1					1	1	RG	N
Scotina gracilipes							1	1									1	1	CR	Hd
Coelotes inermis																		1	RG	N

Species	DM	HV	MH	LIMBU	BR	BU	KH	ANTWE	GP	SJ	VV	WE-FL	LO	WH	ZW	COAST	ALL 12	FLAND	RLC	HAB
Histopona torpida																		1	RG	N
Zora silvestris		1		1													1	1	EN	Hd
Hahnia candida																		1	RG	N
Hahnia nava		1		1	1		1	1						1	1	1	1	1	EN	God
Ero aphana													1			1	1	1	RG	N
Ero tuberculata														1		1	1	1	VU	God
Achaearanea riparia																		1	VU	God
Anelosimus aulicus					1			1									1	1	RG	N
Anelosimus pulchellus																		1	RG	N
Crustulina guttata	1	1	1	1			1	1	1	1		1					1	1	VU	God
Crustulina sticta									1			1					1	1	CR	M
Dipoena inornata		1		1													1	1	CR	Hd
Dipoena melanogaster					1		1	1							1	1	1	1	EN	God
Dipoena prona		1		1													1	1	EN	God
Dipoena tristis		1	1	1	1			1									1	1	CR	God
Enoplognatha mordax															1	1	1	1	VU	God
Enoplognatha oelandica													1		1	1	1	1	EN	God
Enoplognatha tecta						1		1									1	1	RG	N
Episinus truncatus																		1	CR	God
Euryopis flavomaculata	1	1	1	1	1	1	1	1	1			1		1		1	1	1	VU	God
Pholcomma gibbum	1	1	1	1		1	1	1	1		1	1	1	1		1	1	1	VU	God
Robertus arundineti			1	1									1		1	1	1	1	EN	Gow
Robertus scoticus																		1	RG	S
Steatoda albomaculata	1		1	1	1		1	1									1	1	VU	Hd
Steatoda phalerata	1			1	1		1	1									1	1	VU	Hd
Theonoe minutissima	1			1													1	1	VU	Hw
Theridion instabile																		1	EN	M
Theridion uhlighi			1	1			1	1									1	1	CR	Hd
Tetragnatha reimoseri																		1	CR	M
Tetragnatha striata																		1	EN	M
Agalenatea redii	1		1	1	1		1	1					1			1	1	1	VU	God
Argiope bruennichi	1			1													1	1	RG	N
Cyclosa oculata	1			1													1	1	RG	N
Hypsosinga albovittata	1		1	1			1	1							1	1	1	1	VU	God
Hypsosinga heri	1			1											1	1	1	1	EN	Gow
Hypsosinga pygmaea							1	1									1	1	EN	Hw
Hypsosinga sanguinea		1	1	1	1			1									1	1	EN	Hd
Singa hamata																		1	EN	Gow
Acartauchenius scurrilis	1	1		1			1	1					1	1		1	1	1	EN	God
Araeoncus crassiceps	1		1	1	1		1	1									1	1	EN	Hw
Baryphyma duffeyi													1		1	1	1	1	CR	Sa

Species	DM	HV	MH	LIMBU	BR	BU	KH	ANTWE	GP	SJ	VV	WE-FL	LO	WH	ZW	COAST	ALL 12	FLAND	RLC	HAB
Baryphyma maritimum													1	1	1	1	1	1	EN	God
Baryphyma pratense													1	1	1	1	1	1	VU	Gow
Baryphyma trifrons																		1	CR	Hd
Ceratinopsis romana	1			1									1	1		1	1	1	EN	God
Ceratinopsis stativa															1	1	1	1	RG	N
Dismodicus elevatus														1		1	1	1	RG	S
Entelecara congenera		1		1			1	1									1	1	RG	S
Entelecara errata																		1	RG	N
Entelecara media														1		1	1	1	RG	S
Entelecara omissa	1			1													1	1	CR	Gow
Erigone promiscua							1	1					1	1		1	1	1	CR	God
Erigonella hiemalis	1			1			1	1									1	1	RG	S
Erigonella ignobilis	1			1													1	1	EN	Gow
Glyphesis cottonae			1	1													1	1	CR	Hw
Gongylidiellum murcidum																		1	CR	M
Hylyphantes nigritus																		1	RG	N
Hypomma fulvum																		1	VU	M
Hypselistes jacksoni		1	1	1													1	1	EN	Hw
Maso gallicus									1			1	1	1		1	1	1	EN	Gow
Metopobactrus prominulus		1		1	1		1	1					1	1	1	1	1	1	VU	God
Mioxena blanda		1	1	1							1	1		1		1	1	1	RG	N
Monocephalus castaneipes															1	1	1	1	RG	S
Notioscopus sarcinatus																		1	CR	Hw
Pelecopsis nemoralis													1	1		1	1	1	EN	God
Pseudocarorita thaleri																		1	RG	S
Pseudomaro aenigmaticus																		1	RG	N
Satilatlas britteni			1	1	1		1	1									1	1	CR	Hw
Savignya frontata																		1	VU	Gow
Silometopus ambiguus													1		1	1	1	1	CR	Sa
Silometopus bonessi							1	1									1	1	CR	Hd
Silometopus elegans	1		1	1	1		1	1						1		1	1	1	VU	Gow
Silometopus incurvatus	1		1	1			1	1							1	1	1	1	EN	God
Silometopus reussi					1			1					1			1	1	1	VU	Gow
Thyreostenius biovatus																		1	CR	God
Tmeticus affinis																		1	VU	M
Trichoncus hackmanni	1			1													1	1	CR	R
Trichopterna cito	1	1		1			1	1					1	1	1	1	1	1	VU	God
Trichopterna thorelli					1	1	1	1					1			1	1	1	EN	Gow
Walckenaeria alticeps					1	1		1									1	1	CR	M
Walckenaeria kochi			1	1			1	1									1	1	RG	S
Walckenaeria nodosa			1	1											1	1	1	1	EN	Gow

Species	DM	HV	MH	LIMBU	BR	BU	KH	ANTWE	GP	SJ	VV	WE-FL	LO	WH	ZW	COAST	ALL 12	FLAND	RLC	HAB
Walckenaeria stylifrons													1		1	1	1	1	EN	God
Allomengea scopigera													1			1	1	1	CR	Sa
Allomengea vidua														1		1	1	1	VU	Gow
Aphileta misera	1		1	1	1		1	1									1	1	EN	Hw
Bathyphantes setiger	1	1	1	1			1	1							1	1	1	1	EN	Hw
Bolyphantes luteolus													1	1	1	1	1	1	RG	S
Carorita paludosa																		1	EN	M
Centromerus capucinus			1	1													1	1	RG	N
Centromerus incultus		1	1	1													1	1	EN	Hw
Centromerus leruthi																		1	RG	N
Centromerus levitarsus						1		1									1	1	CR	M
Centromerus pabulator		1		1			1	1									1	1	RG	W
Centromerus serratus																		1	RG	N
Donacochara speciosa	1			1													1	1	VU	Gow
Drepanotylus uncatus	1			1		1	1	1									1	1	EN	M
Frontinellina frutetorum																		1	RG	W
Halorates distinctus																		1	EN	Gow
Haloratus reprobus																		1	CR	Sa
Kaestneria dorsalis	1			1										1		1	1	1	VU	God
Lepthyphantes lepthyphantiformis																		1	RG	W
Leptorhoptrum robustum																		1	VU	R
Leptothrix hardyi														1		1	1	1	EN	Gow
Linyphia tenuipalpis																		1	CR	Hd
Macrargus carpenteri		1		1													1	1	RG	S
Meioneta beata	1	1	1	1			1	1					1		1	1	1	1	EN	God
Meioneta fuscipalpis																		1	RG	W
Microlinyphia impigra	1			1	1			1									1	1	VU	M
Taranucnus setosus	1		1	1	1	1		1									1	1	VU	Hw

Western Flanders (WE-FL). The other really sandy region is the Campine region. As already mentioned, as well as the coastal regions, the Campine region has also a very high biodiversity in its spider fauna.

Methods

We compiled the list (Table 3) of the Threatened and Geographically restricted species occurring in twelve areas distributed over the sandy regions of Flanders (Figure 2).

Three of the study areas are localised in the eastern part of the Campine region in the province of Limburg (LIMBU): Mechelse heide (MH), De Maten (DM) and Hageven (HV). This region stretches across the north-east of the Flemish region. Niveo-eolian sands cover it. Soils are distinctly podsolized so that they have an endured horizon of illuvial humus and/or iron, about 30 to 40 centimetres below surface. This gives the Campine soils the characteristics of being both sandy and waterlogged, with water accumulating on the impermeable horizon of the soil profile. Hence, we find in the remaining natural areas a fine mosaic of very dry sandy areas and dunes on the one hand and lakes, marshes and peat bogs on the other hand. Until the nineteenth century the region was almost completely covered by heathland, which had been developed under a balanced agro-pastoral system. Drainage, irrigation, pine wood plantation and the use of fertilisers dramatically transformed it. There are however still important remnants of heathland. Each of these areas has a

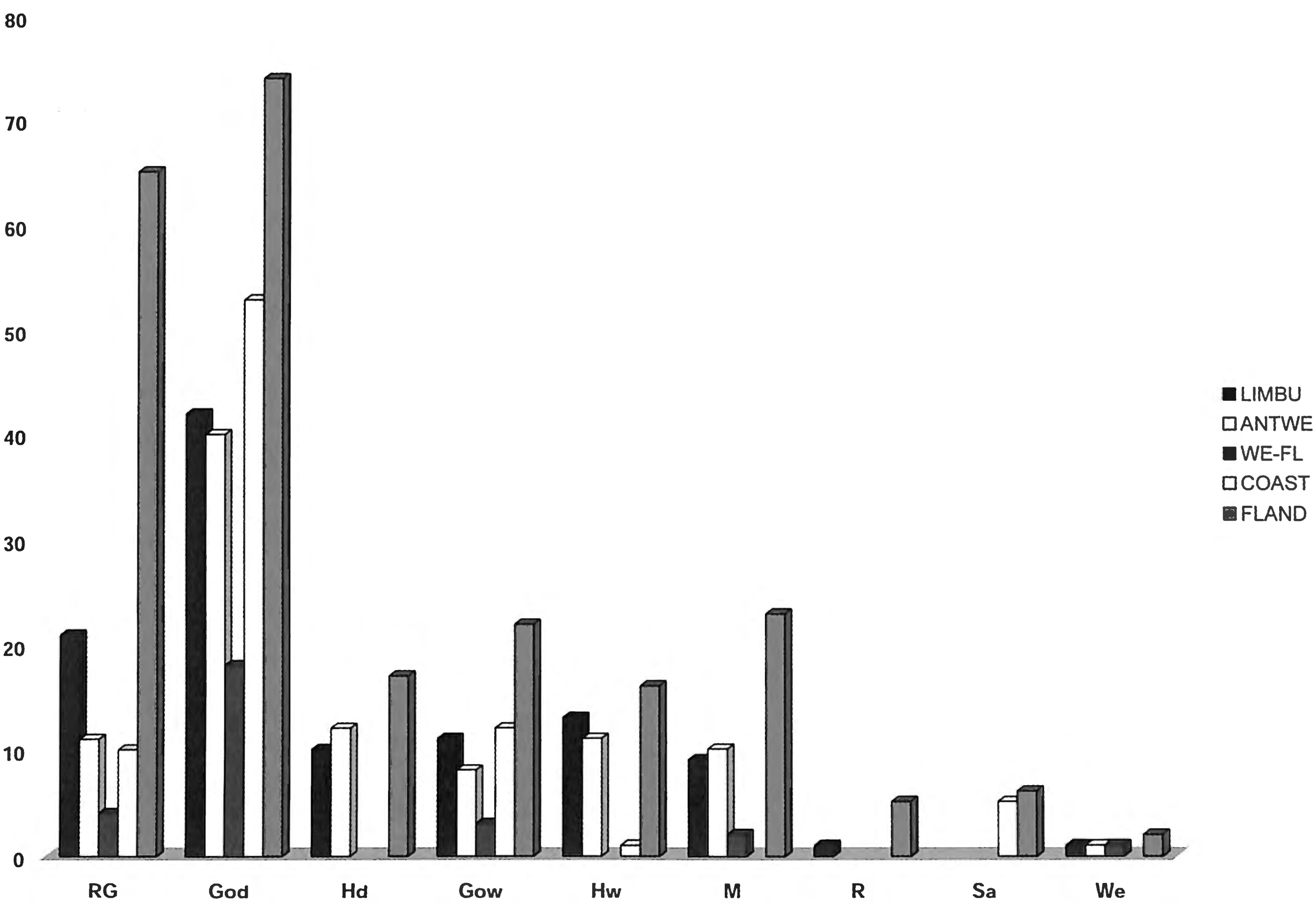


Fig. 3 — Number of species per habitat type per group of three areas and in Flanders.

surface area of at least hundred hectares. The spiders of these three nature reserves were sampled by JANSSEN (1980, 1987, 1991).

Three other areas were localised in the western part of the Campine region (province of Antwerp: ANTWE): Kalmthoutse heide (KH), Brecht's groot schietveld (BR) and Buitengoor (BU). The first is a Flemish nature reserve of more than thousand hectares. The second is military area of almost two thousand hectares. BU is a small area in the valley of a rivulet of only some forty hectares. The spiders occurring in these areas were sampled by HENDRICKX (unpublished data), JOCQUÉ (1986), LAVRYSSEN (1993) and MAELFAIT *et al.* (1993).

Three very small natural areas of only a few to a few tens of hectares are situated in the more sandy parts of the province of Western Flanders (WE-FL) in the vicinity of Bruges: Vloethemveld (VV), Schobbejakshoogte (SJ) and Gulke putten (GP) (MAELFAIT, unpublished data; MAELFAIT & JANSSEN, unpublished data; ALDERWEIRELDT & POLLET, 1990).

All these inland sites were compared with three coastal areas: Zwin (ZW): some two hundred hectares of salt marsh and dune habitats at the Dutch border; Lombardsijde (LO): dunes and salt marshes along the estuary of the river IJzer and Westhoek (WH): a few hundred hectares of wet and dry dune habitats at the French border (BAERT & DESENDER, 1993; BAERT & MAELFAIT, 1999; BONTE et al., 1999; HUBLÉ, 1975, 1976; MAELFAIT et al., 1997; NIJS, 1976)

Results

Of the 269 spider species of Flanders which are threatened and restricted geographically, 230 are not bound to forest habitats (Table 3, column FLAND). Of these 230 species 164 occur in the twelve study areas (column ALL12). This confirms that here, we are really dealing here with hot spots of biodiversity and that we have included a significant part of the spider fauna for analysis. By far the largest number of species occurs in the most eastern province of the Campine region (Limburg: LIMBU), rather less in Antwerp (ANTWE), much less in the three small reserves in Western Flanders (WE-FL) and again only a bit less in the three coastal areas taken together (COAST). When we subtract from these species numbers the rare species at the limit of their distribution (RG-species), the difference between Limburg and the

Table 4 — Number of Red list species per category per group of three areas, in all twelve areas and in Flanders.

RLC	*LIMBU*	*ANTWE*	*WE-FL*	*COAST*	*ALL12*	*FLAND*
RG	21	11	4	10	35	65
Threatened	87	82	24	71	129	165
TOTAL	108	93	28	81	164	230

other species rich regions (Antwerp and the coast) becomes less pronounced (Table 4). The higher number of geographically restricted species in Limburg, compared with all other provinces, is caused by a high number of species having their northern limit in that region. They probably occur there and not in the rest of Flanders because of the somewhat warmer summers and perhaps because of the presence nearby of the river Rhine, which forms a corridor for southerly species to the north.

Excluding the regionally restricted species from the comparison, the three coastal areas still contain about 10 to 15 species less than the Campine areas. To find the reason for that difference we compiled Figure 3. In that figure we have indicated for each preferred habitat the number of species respectively occurring in (from left to right): Limburg (LIMB), Antwerp (ANTWE), the three sandy areas in Western Flanders (WE-FL) and in the three coastal areas (COAST). At the outermost right, we indicated the total number of Flemish threatened species preferring that habitat category (FLAND). Here again, we see that in Limburg there occurs a considerable larger number of geographically restricted species compared with the three other regions. The larger number of threatened species bound to dry grassland, that occur in the coast region, is compensated by the species restricted to dry heath land situations in Antwerp and Limburg. A comparable number of threatened species of wet grasslands is found in the eastern provinces and along the coast. As this is the case for almost all other habitat categories, the number of species belonging to the habitat category "wet grasslands", occurring in the small relict heath lands near Bruges, in Western Flanders, is much lower than in the other regions. The number of marshland species is high in the two eastern provinces. That number is not fully compensated by salt marsh-bound red list species of the coast region. Besides the difference in the number of species between the Campine region and the coast, there are about ten, wet heath land species of the Limburg and Antwerp areas, which are not represented along the coast. It can be concluded that the threatened species bound to oligo- and mesotrophic wetland habitats (incl. peat bogs) provide the difference between the Campine region and the coast region. Their presence is responsible for the higher spider biodiversity of the Campine region in comparison with the coast region. Examples of such species are: the erigonid *Araeoncus crassiceps*, the lycosids *Pardosa sphagnicola, Pirata piscatorius, Pirata tenuitarsis* and *Pirata uliginosus*, the salticid *Sitticus caricis* and the pisaurid *Dolomedes fimbriatus.*

Discussion

P. sphagnicola and *P. uliginosus* are, in our country, bound to ombrotrophic *Sphagnum* (peat) bog situations (ALDERWEIRELDT & MAELFAIT, 1990). That is a habitat type occurring in the Campine region and not in our coastal region. Species bound to oligotrophic wet grasslands with low sedges (vegetation of the *Caricetum trinervis-nigrae*-type, WESTHOFF ex FOUCOULT 1984; SCHAMINÉE *et al.*, 1995) such as *Pirata piscatorius* and *P. tenuitarsis* are also absent in our coastal dunes. However, based on their habitat preference, we can assume that their absence may be the result of recent extinction following habitat destruction. Oligotrophic dune slack fens with analogue vegetation were present until the 19th century along the Flemish West coast (DE RAEVE *et al.*, 1983) on former fossil beach planes and along the dune-polder border zone. Due to the intensive agricultural land use and forestation of these wetlands with Alder (PROVOOST & HOFFMANN, 1996a), the habitat disappeared. This is also the case for the mesotrophic fen sedge beds (*Cladietum marisci*-vegetation type, ALLORGE ex ZOBRESIT 1935; SCHAMINÉE *et al.*, 1995), a typical former dune-polder habitat, characterised by stable high groundwater levels and sand-silt substrate conditions. This is the typical habitat of *Dolomedes fimbriatus*. The absence of this species may thus also be the result of historical habitat loss. Indirect evidence for the above given explanation for the absence of the three species bound to oligotrophic grassland conditions is their presence in the nearby coastal dune region of northern France (Boulonnais), where these habitats are still well preserved (BONTE, unpublished data).

Whether habitat restoration along the Flemish coasts (as proposed by PROVOOST & HOFFMANN, 1996b) would lead to the re-colonisation by these species is questionable: colonisation depends both on the presence of neighbouring populations and on the species specific dispersal capacities. Of these species, no nearby populations are known, so a very well developed aerial dispersal would probably be necessary to enhance (re-) colonisation. There are however no specific data on this behaviour.

We can conclude that the contemporary absence of typical wet heath land spider species in the coast region results from the geological, climatological and pedological impossibility for developing particular habitat types (ombrotrophic *Sphagnum* bogs) as well as from historical anthropogenic habitat loss. It is the absence of these particular wet heath land habitat types that makes that the spider fauna of the Belgian coast is what it is, and although being a species rich fauna, it is markedly poorer than the spider fauna of the heath land areas in the Campine region.

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